

POLAND/Physical Chemistry. Thermodynamics. Thermochemistry. B
Phase Transitions. Equilibria. Physico-Chemical
Analysis.

Abs Jour: Ref. Zhur. - Khimiya, No. 4, 1959, 10987

Authors : Ciberowski J., Wronski S.

Inst : Not given

Title : A Psychometric Chart for the System, Air - Ethyl
Acetate.

Orig Pub: Chem.stosow, 1958, 2, 147-152.

Abstract: On the basis of literature data, a psychometric
diagram was drawn for the system, air - ethyl
acetate. A disagreement between the psychometric
and adiabatic lines was discovered. A comparison
of some points, taken from this diagram, with a
few experimental results, previously obtained
(Mark I. G., Trans. Amer. Inst. Chem. Engrs., 1932,

Card 1/2

CIBOROWSKI, J.

21
Heat transfer in fluidized systems. I. The dynamics of coarse-grained beds at elevated temperatures and high fluidized beds. Janusz Ciborowski and Jerzy Roszak. Chem. Sorowana 2, 305-17 (1968). In an introductory investigation on the heat transfer in fluidized beds, certain facts concerning the dynamics of thick solid particles at elevated temps. and high fluidized beds were found. A fixed bed of considerable height cannot be transferred instantly into fluidized state at a given gas-flow velocity; the transition occurs gradually (first only in the higher parts of the bed), and within a certain range of gas velocities. The initial value of the range (crit. velocity) for the change of temps. from 20 to 100° does not depend on the temp. of the system examd. A straight-line relation (in logarithmic coordinates) between porosity and gas-flow velocity does not hold for thick solid-particle beds.

3

TA
11

MR

41
 ✓ Heat transfer in fluidized systems. II. Heat transfer coefficient between the wall and the fluidized system, and between gas and solid particles. Janusz Ciborowski and Jerzy Roszak. *Chemia Sposowami* 2, 410-88 (1978), cf. preceding abstr.—Temp. measurements were made in the axial and radial directions of the fluidized systems. Differences between the temp. of the solid phase and the temp. of the gas were found. Coefficients of heat transfer between gas and solid particles (sand and coke) were obtained. These coeffs. increased with increased diam. of solid particles, and were independent of gas velocity.

Gregor Melnyk

3

4E3d

2-4E 3c

1-RS

TA
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RR

CIBOROWSKI, J.

TSIBOROVSKIY, Ya. [Ciborowski, J.]; ROSHAK, Ya. [Roszak, J.]

Investigating the heat exchange between a heated surface and
a boiling layer [with summary in English]. Inzh.-fiz.sbur.
no.12:8-17 '58. (MIRA 11:12)

1. Politekhnikheskiy institut, Institut obshchey khimii, g.
Varshava.

(Heat--Transmission)

POLAND / Chemical Technology, Chemical Products and Their
Application. Chemical Engineering.

E-2

Abs Jour : Ref Zhur - Khimiya, No 5, 1959, No. 15600

Author : Ciborowski, J.; Selecki, A.

Inst : Not given

Title : Certain Data on the Evaporation of Liquids from Particles
of the Pseudo-Dilute Layer

Orig Pub : Chem. stoscw., 1958, 2, No 2, 135-145

Abstract : Experiments devoted to the determination of evaporation
rates were conducted in a 70 mm diameter glass column,
packed with moistened ceramic balls of 0.71 mm diameter,
with hot air passing through this column, at a variable
rate (1760-2650 kg/m²/ hr.), at a temperature ranging from
91° to 162°, and at a variable rate of spraying that ranged
11 to 208 kg/m²/ hr. It was established that low rates of
spraying do not affect the pseudo-dilute layer. A critical

Card 1/2

POLAND / Chemical Technology, Chemical Products and Their
Application. Chemical Engineering.

112

Abs Jour : Ref Zhur - Khimiya, No 5, 1959, No. 15600

spray density was determined that suppressed the process.
Feasibility of utilization of liquid vaporization from
particles contained in the pseudo-dilute layer has
been indicated for the air humidification applications. --
S. Globov

Card 2/2

H-2

Ciborowski, J.

Country : POLAND
 Category : Chemical Technology. Chemical Products and
 Their Application. Chemical Engineering
 Abs. Jour : Ref. Zhur.-Khimiya, 1959, No 14, No 49779
 Author : Ciborowski, J.; Roszak, J.
 Institut. : Not given
 Title : Distribution of Heat in the Pseudo-Fluidized
 Layer. I. Aerodynamics of the Upper Pseudo-
 Fluidized Layer Containing Coarse Solid*
 Orig Pub. : Chem. stosow., 1958, 2, No 3, 305-317
 Abstract : Described is an experimental plant used in the
 investigation of aerodynamics and thermoki-
 netics of pseudo-fluidized layer (P.F.) The
 plant included a 5 cm diameter 1 m high
 column. The method of operation and the results
 of experiments pertaining to aerodynamics of
 the PF and conducted for the air-river sand
 or coke (0.164-2.16 mm in size) systems are
 presented. It has been established that the

* Particles at Elevated Temperatures

Card: 1/3

Country :
Category :
Abs. Jour : Ref. Zhur.-Khimiya, 1959, No 14, No 49770
Author :
Institut. :
Title :
Orig. Pub. :
Abstract : transition from static layer to PF takes place
Con'd gradually with the process of pseudo-fluidi-
zation starting in the upper portion of the
layer. Lowering of the hydraulic resistance
of the static layer is indicated. This
occurs after the preliminary pseudo-fluidi-
zation. Formation of two sharp slope changes
on the resistance curve was observed. The
first change corresponds to the transition
of the static state into PF, and the second
Card: 2/8

H-4

COUNTRY : POLAND H
CATEGORY : Chemical Technology. Chemical Products and their
Applications. Chemical Engineering.
ABS. JOUR. : RZhKhim., No 17, 1959, No. 61103
AUTHOR : Ciborowski, J.
INSTITUTE : -
TITLE : Condensation of The Subliming Materials. I.
ORIG. PUB. : Chem. Stasow., 1958, 2, No 4, 401-417

ABSTRACT : A graphical method for the determination of the
effectiveness of condensation of vapors of the
subliming materials when mixed with cold inert
gases is proposed. In an example involving the
air-naphthalene system the dependancy of effi-
ciency on temperature and extent of vapors' super-
heating, on the quantity and temperature of
cooled inert gas and on general pressure level
over the solid phase are reviewed.
-- A. Rovinskiy

Card: 1/1

H - 3

COUNTRY : Poland
CATEGORY :

H-2

ABS. JOUR. : RZKhim., No. 22 1959, No.

78796

AUTHOR :
INST. :
TITLE :

ORIG. PUB. :

ABSTRACT : all cases the temperature of the particles was equal to or slightly higher than the gas temperature. Three heat transfer coefficients are discussed, calculated from the mean integral and mean logarithmic gas temperatures as well as from the temperature of the solid particles. The value of the heat transfer coefficient between the gas and the particles increases with increasing d , and in the systems investigated, which are characterized by a relatively great height of the bed and

CARD: 2/3

147

CIBOROWSKI, J.; WITKOWSKI, S.

Concerning the drying of sawdust in a fluidic phase. p. 102.

PRZEMYSŁ DRZEWNY. Centralne Zarząd Przemysłów: Drewnego, Meblarskiego, i Lesnego i Stowarzyszenie Inżynierów i Techników Lesnictwa i Drzewnictwa. Warszawa, Poland, Vol. 9, No. 4, Apr. 1958.

Monthly List of East European Accession (EEAI), IC, Vol. 8, No. 9, September, 1959.
Uncl.

Country : POLAND
 Category : Chemical Technology. Chemical Products and
 Their Applications. Chemical Engineering
 Aba. Jour : Ref. Zhur.-Khimiya, 1959, No 14, No 49781
 Author : Ciborowski, J.; Bulanda, J.
 Institut. : ~~Not given~~ POL. Tech., WARSAW.
 Title : The Role of Diffusion in the Evaporation of
 Two-Component Liquids
 Orig. Pub. : Przm. chem., 1958, 37, No 8, 516-519
 Abstract : Presented is theoretical analysis of the eva-
 poration process involving two-component
 liquids in the stream of inert gas. Based on
 the diffusion theory a method for calculating
 the rate of evaporation is presented together
 with the nomogramme based on the utilization
 of the Lewis' approximation equation (Lewis
 W.K., Ind. Eng. Chem., 1935, 27, 1395). Compa-
 rison of calculated data for benzene-toluene-
 -air system. obtained in accordance with more
 exact Gilliland's method (Gilliland E.R.,
 Ind. Eng. Chem., 1934, 26, 516) against those
 Card: 1/2

H-5

COUNTRY	: Poland	H-8
CATEGORY	:	
ABS. JOUR.	: RZKhim., No. 21 1959, No.	75402
AUTHOR	: Ciborowski, J. and Wronski, S.	
INST.	: <u>Not given</u>	
TITLE	: The Reduction of Sodium Sulfate with Hydrogen in Fluidized Beds	
ORIG. PUB.	: Przemysl Chem, 37, No 8, 520-522 (1958)	
ABSTRACT	<p>: The possibility of carrying out the reduction of Na_2SO_4 in fluidized beds at temperatures exceeding the melting point of the eutectic has been investigated. The reaction proceeds at low sulfate concentrations and at high hydrogen rates, assuring intensive mixing. The sulfate is reduced in 8 min when mixtures containing 5 and 7.5% sulfate are used and the grain size in the charge is 0.15-0.3 mm, in the presence of 1% iron (catalyst). The reduction is accompanied by an increase in the size of the grains as a result of agglomeration.</p> <p style="text-align: right;">From authors' summary</p>	
CARD:	1/1	

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CIBOROWSKI, J.

~~Simultaneous mixing and drying of salts by the fluidizing technique. Jacek Carnota, Andrzej Wolny, and Janusz Ciborowski (Inst. Chem. Orgchem. Warsaw). Przemysl Chemiczny, 57, 883-4 (1958) (English summary).~~ Simultaneous mixing and drying of NH_4NO_3 and NaCl has been studied on a pilot-plant scale. Both batch and continuous methods were applied. The above salts were also dried by the fluidization technique sep. The batch method produced products with the H_2O content: NH_4NO_3 alone 0.03%, NaCl alone 0.005%, and the mixt. of both salts 0.01%. In continuous operation with residence time 12 min. and temp. 12° the mixt. attained 0.04% H_2O content. The throughput in the pilot plant was 20 kg./hr. F. I. Hendel

CIBOROWSKI, J.

Catalytic oxidation of naphthalene to phthalic anhydride by fluidized technique in a pilot plant. I. H. Jachimski, J. Janowski, Jan Ornowski, Janusz Glibowski, Jolita Schimmschneiders, Alfred Grabke, and Michael Szwarc (Inst. Chem. Org. (Warsaw) *Przemysl. Chemic.* 87, 711-719 (1968) English summary). 708-7 (1968) (no summary). — With V catalyst and 0.4–0.7 sec. contact time the yield was 70–83%. The catalyst was prepd. by melting V_2O_5 on activated alumina resulting in a grain size 0.48–0.84 mm. and 0.84–2.00 mm. with V_2O_5 content 69%, and also by melting on corundum resulting in a grain size 1.8–3.6 mm. with V_2O_5 content 10%. The catalytic oxida. was carried out at 450–90° by using 0.1 kg. naphthalene/1 kg. of catalyst/hr. Depending on the grain size and type of catalyst, the height of the catalyst was 30–60 cm. (for corundum catalyst 60 cm. was used). The purity of the raw material was 97–99%. F. J. Hendel

10

4E3d

2 gms (w/13)

4825 (p)

97

CIBOROWSKI, J.

TSIBOROVSKIY, Ya. [Ciborowski, J.]; ROSHAK, Ya. [Roszak, J.]; CATILLO, P.D.
[translator]

Investigating the heat-exchange between a heated surface and a
fluidized layer [with summary in English]. Inzh.-fiz.zhur.
no.1:15-24 Ja '59. (MIRA 12:1)

1. Politekhicheskiy institut i Institut obshchey khimii,
Varshava.

(Heat--Radiation and absorption)

CIBOROWSKI, J.

TSIBOROVSKIY, Ya.; ROSHAK, Ya.

Investigating the heat exchange between gas and solid particles of a
boiling layer. Inzh.-fiz.zhur. no.2:3-9 F '59. (MIRA 12:3)

1. Politekhnikheskiy institut, Institut obshchey khimii, g. Varshava.
(Heat--Radiation and absorption)

CIBORCWSKI, Janusz; ROSZAK, Jerzy

On heat transfer in fluidized systems III. A discussion of the results and conclusions as to the mechanism of the flow of heat. Chemia stosow 3 no.1:15-35 '59.

1. Zaklad Inzynierii Chemicznej, Politechnika, Warszawa, i Instytut Chemii Ogolnej, Warszawa.

CIBOROWSKI, J.

Distr: 4E3c 2 cys

Heat transfer in fluidized systems. III. Discussion of results and conclusions concerning the mechanism of heat transfer. Janusz Ciborowski and Jerzy Roszak (Politechnika, Warsaw). Chem. Stosowana 3, 15-35(1989)

(English summary); cf. C.A. 53, 20948b. The coeff., α_w , kcal./sq. m. (°C.) (hr.), of heat transfer between wall and gas in air-fluidized beds of sand and coke, based on log mean temp. of gas, was correlated with particle diam. d' , mm., and superficial mass velocity of gas G kg./sq. m. sec., and G_0 at the point of min. fluidization, by the following equations: $\alpha_w = 55(d')^{0.44}(G-G_0)^{0.71}$ for $d' = 0.163-0.690$ within $\pm 15\%$, and $\alpha_w = 50(\rho)^{-0.14}(d')^{0.44}(G-G_0)^{0.71}$ for exptl. particle-shape factors; $\rho = 1.14-1.16$ (sand) and $3.09-2.85$ (coke), $d' = 1.00-2.18$, and $G/G_0 = 1.05-1.8$ within $\pm 11\%$. For a fixed bed: $\alpha_w = 28(d')^{0.44}G$. The difference between heat-transfer coeffs. in fluidized and fixed beds proved spurious; for deeper beds, the heat exchange in fluidized systems was only slightly better than in fixed ones. The bed height effect is less on α_w than on gas-to-particle heat-transfer coeffs. Heat exchange in deeper coarse-grained beds with vigorous slugging was not below that in fine-grained ones. The mechanism of heat transfer is discussed. A. Szafranski

TSIBOROVSKIY, Ya. [Ciborowski, J.]

Graphic method for determining the degree of sublimation condensation. Inzh.-fiz. zhur. no.11:43-47 N '59 (MIRA 13:3)

1. Politekhnicheskiy institut, Varshava.
(Sublimation (Physical sciences))

CIBOROWSKI, Janusz; WRONSKI, Stanislaw

Investigation of sublimating condensation of naphthalene by mixing with fluidal charge. Chemia stosow 3 no.4:447-460 '59. (KEAI 9:6)

1. Zaklad Inzynierii Chemicznej Politechniki Warszawskiej i
Instytutu Chemii Ogolnej.
(Naphthalene)

CIBOROWSKI, J.

5(2)

SOV/80-32-3-1/43

AUTHORS: Cyborowski, J., Wiatowski, S.

TITLE: Reduction of Sodium Sulfate by Hydrogen in a Pseudo-Liquefied Layer (Vosstanovleniye sul'fata natriya vodorodom v pseudo-ozhizhennom sloye)

PERIODICAL: Zhurnal prikladnoy khimii, 1959, Vol XXXII, Nr 3, pp 473-477 (USSR)

ABSTRACT: Na_2S may be obtained by the reduction of Na_2SO_4 using hydrogen as reducing agent [Ref 1, 2]. An apparatus has been developed for this purpose (Figure 1). The experiments were carried out in two series: in homogeneous Na_2SO_4 and in a mixture of Na_2SO_4 and Na_2S . The reaction in the homogeneous substance proceeded in various stages at 620, 640, 680 and 720 - 760°C. The final product contained 86 - 97% Na_2S . In the mixture hydrogen was introduced at the rate of 20 l/min. At low temperatures the sulfide yield was 88%, above 700°C 97%. An iron catalyst in the amount of 1% was used in the experiments. The consumption of hydrogen was only 5% under the most favorable conditions.

Card 1/2 There are 3 graphs, 1 diagram and 10 references, 3 of which

SOV/80-32-3-1/43

Reduction of Sodium Sulfate by Hydrogen in a Pseudo-Liquefied Layer

are Soviet, 3 German, 2 English, 1 Polish and 1 American.

ASSOCIATION: Kafedra protsessov i apparatov khimicheskoy tekhnologii Varshavskogo politekhnicheskogo instituta i instituta obshchey khimii (Chair of Processes and Apparatuses of Chemical Technology of the Warsaw Polytechnical Institute and the Institute of General Chemistry)

SUBMITTED: June 17, 1958

Card 2/2

GIBOROWSKI, Janusz

A graphic method of determining the rate of subline condensation II. Condensation by expansion during diaphragmatic cooling and its limitations. Chemia stosow 3 no.2:187-199 '59.

1. Zaklad Inzynierii Chemicznej Polskiej Akademii Nauk, Warszawa i Politechnika, Warszawa.

CIBOROWSKI, Janusz

On reversible and irreversible processes in the humidification and dehumidification of gases. Chemia stosow 3 no.3:321-338 '59.

1. Zaklad Inzynierii Chemicznej, Polska Akademia Nauk, Warszawa i Zaklad Inzynierii Chemicznej, Politechnika, Warszawa.

CIBOROWSKI, Janusz; WLODARSKI, Andrzej

Primary observations of the influence of electrostatic phenomena upon fluidization processes. Chemia stosow 3 no.3:339-352 '59.

1. Zaklad Inzynierii Chemicznej i Polska Akademia Nauk, Warszawa i Zaklad Inzynierii Chemicznej, Politechnika, Warszawa.

CIBOROWSKI, Janusz; WRONSKI, Stanislaw

Testing of sublimating condensation of naphthalene by mixing with a fluidal charge. Chemia stosow 3 no.4:447-460 '59.

1. Zaklad Inzynierii Chemicznej, Politechnika, Warszawa i Instytut Chemii Ogolnej, Warszawa.

CIBOROWSKI, Janusz

On the specialized curriculum of the studies in chemical engineering. Przem chem 39 no.3:152-154 Mr '60.

1. Katedra Inżynierii Chemicznej, Politechnika, Warszawa

P/014/60/039/010/002/004
A224/A126

AUTHORS: Ciborowski, Janusz, and Młodziński, Bolesław

TITLE: A new method of preparing elemental sulphur from indigenous ore

PERIODICAL: Przemysł chemiczny, v. 39, no. 10, 1960, 608-613

TEXT: A new method of preparing elemental sulphur from ore deposits near Tarnobrzeg is described. The method consists in simultaneous burning and distillation of sulphur in a fluidized bed. The heat released by burning part of the sulphur to sulphur dioxide is used to melt the remaining sulphur. The thermodynamical criteria of the process are analyzed and the results of the theoretical analysis are tested on an experimental setup. Results indicate that a high distillation efficiency is obtained by keeping the temperature of the process as low as possible, usually below 600°C. The amount of elemental sulphur left in the cinder is below 0.01% and varies little with the temperature of the process. The amount of compound sulphur varies from 1.8 to 4.7% and increases with the temperature. With

Card 1/2

A new method of preparing elemental...

P/014/60/039/010/002/004
A224/A126

a poor ore, containing 20% of sulphur, 45-75% of the total sulphur amount can be distilled the rest being burnt to sulphur dioxide. Higher values are obtained with richer ores. A preliminary technical and economical analysis of this process, conducted by the Zakład Analiz i Wycen Techno-ekonomicznych Instytutu Chemii Ogólnej (Technical and Economical Analysis Department of the Institute of General Chemistry), indicate an extremely low cost of sulphur thus obtained, especially if the total amount of sulphur dioxide obtained in the process were to be utilized for sulphuric acid manufacture. There are 11 tables, 3 figures and 5 references: 2 Soviet-bloc and 3 non-Soviet-bloc.

ASSOCIATION: Zakład Inżynierii Chemicznej Instytutu Chemii Ogólnej i Politechniki Warszawskiej (Department of Chemical Engineering of the Institute of General Chemistry and the Warszawa Polytechnical School).

SUBMITTED: July 6, 1960

Card 2/2

23510
P/014/60/039/012/005/007
A221/A126

5.1105
AUTHORS: Ciborowski, Janusz, and Pohorecki, Ryszard
TITLE: A survey of computation methods of technical absorption equilibria
PERIODICAL: Przemysł Chemiczny, v. 39, no. 12, 1960, 762 - 768

TEXT: The authors critically discuss several methods of computing inter-phase equilibria, proposed by various authors. One of the basic problems of chemical engineering is the determination of inter-phase equilibria between gas and liquid. There are several methods described in literature, concerning the conditions under which the temperature of the system is lower than the critical temperature of its gaseous component. If, however, the temperature of the system is higher than the critical one, which is usually the case in absorption systems, the calculation of the equilibrium is complicated and difficult. Some information on this subject can be found in various manuals, but it is superficial and often inaccurate. Usually all methods refer to the Henry's Law, but without indicating the conditions of

Card 1/3

23510

P/014/60/039/012/005/007
A221/A126

A survey of computation methods of...

application or calculation of the Henry's Constant for the specified system. Most accurate information on this subject can be found in the paper published by Markham and Kobe (Ref. 10: A. E. Markham, K. A. Kobe, Chem. Rev., 28, 519, 1941). Further, the authors discuss a) the applicability of Henry's Law, b) the calculation of equilibria from physico-chemical data concerning the components, c) the method of extrapolating the equilibrium to different pressure and temperature conditions, d) the solubility of gas mixtures, e) the solubility of gases in solutions, and f) the calculation of equilibria in case of non-isothermic absorption. The authors conclude their article by presenting following practical example of calculation: The mixture of methane and air is in equilibrium with liquid benzene. The overall pressure $P = 2$ atm, temperature 25°C , partial pressure of methane $p_m = 0.4$ atm. The task is to calculate the unit content of methane in gaseous phase and equilibrium unit content of methane in liquid phase. There are 4 tables, 1 figure and 39 references: 10 Soviet-bloc and 29 non-Soviet-bloc. The four most recent references to English-language publications read as follows: H. W. Cremer, T. Davies, "Chemical Engineering Practice", London 1958; R. C. Reid, T. K. Sherwood, "The Properties of Gases and Liquids", New York

Card 2/3

A survey of computation methods of...

23510
P/014/60/039/012/005/007
A221/A126

1958; T. K. Sherwood, R. L. Pigford, "Absorption and Extraction", New York
1952; J. H. Hildebrand, J. Phys. Chem., 58, 671 (1954).

ASSOCIATION: Zakład Inżynierii Chemicznej Politechniki Warszawskiej (Poly-
Technical Institute, Chemical Engineering Department), Warsaw

SUBMITTED: May 26, 1960

Card 3/3

Z/011/62/019/001/004/017
E073/E136

AUTHORS: Ciborowski, J., and Steplewski, B.

TITLE: On the influence of particle size on the speed of infrared drying

PERIODICAL: Chemie a chemická technologie. Přehled technické a hospodářské literatury, v.19, no.1, 1962, 22, abstract Ch 62-300. (Chem. stos., v.5, no.1, 1961, 3-16).

TEXT: The influence of the size of sand particles on the speed of drying with infrared rays was investigated. The particle diameters varied between 0.102 and 2.5 mm. The first as well as the second drying period was studied. The existence was proved of an optimum diameter of solid particles which corresponded to the maximum speed of drying. The dependence was determined of the absorption capacity of the sand layer on the size of the particles during heating. A similar relation was found to exist for the heat-transfer coefficient.

9 figures, 1 table, 9 references.

[Abstractor's note; Complete translation.]

Card 1/1

CIBOROWSKI, Janusz; WRONSKI, Stanislaw

The continuous method of sublimating condensation in fluidised bed.
Przem chem 40 no.8:433-436 Ag '61.

1. Katedra Inzynierii Chemicznej Politechniki Warszawskiej i Zaklad
Inzynierii Chemicznej Instytutu Chemi Organicznej.

CIBOROWSKI, Janusz; SURGIEWICZ, Janusz

Studies on the influence of certain factors upon the condensation induced by sublimation by adiabatic expansion. Chemia stosow 5 no.3:337-361 '61.

1. Katedra Inzynierii Chemicznej, Politechnika, Warszaw.

CIBOROWSKI, Janusz; MŁODZINSKI, Bolesław

Kinetics of the drying of hydrated salt in a fluidized bed. Pt. 1.
Przem chem 40 no.9:529-533 S '61.

1. Zakład Inżynierii Chemicznej, Instytut Chemii Ogólnej, Warszawa i
Katedra Inżynierii Chemicznej, Politechnika, Warszawa.

CIBOROWSKI, Janusz; MŁODZINSKI, Bolesław

Kinetics of the drying of hydrated salt in a fluidized bed. Pt. 2.
Przem chem 40 no.10:596-602 0 '61.

1. Zakład Inżynierii Chemicznej, Instytut Chemii Ogólnej, Warszawa i
Katedra Inżynierii Chemicznej, Politechnika, Warszawa.

CIBOROWSKI, Janusz; SURGIEWICZ, Janusz

Testing of the yield of the condensation process of sublimable material by mixing. Przem chem 40.no.11:646-650 N '61.

1. Katedra Inzynierii Chemicznej, Politechnika, Warszawa i Zakład Inzynierii Chemicznej, Instytut Chemii Ogólnej, Warszawa.

CIBOROWSKI, Janusz; WRONSKI, Stanislaw

Sublimating condensation in a membrane cooled fluidized bed.
Chemia stosow 6 no.2:153-165 '62.

1. Katedra Inzynierii Chemicznej, Politechnika, i Zaklad Inzynierii
Chemicznej, Instytut Chemii Ogolnej, Warszawa.

CIBORCWSKI, Janusz; WITKOWSKI, Stanislaw

Studies on the phenomenon of hanging of granular loose chemical products. Przem chem 41 no.2:91-95 F '62.

1. Zaklad Inzynierii Chemicznej, Politechnika, Warszawa

CIBOROWSKI, Janusz; WITKOWSKI, Stanislaw

Studies on the phenomena of the hanging of granular beds.
Przem chem 41 no.2:91-95 F '62.

1. Zaklad Inzynierii Chemicznej, Politechnika, Warszawa.

CIBOROWSKI, Janusz; MŁODZINSKI, Bolesław

On the process of obtaining sulfur by means of the fluidization method. Przem chem 41 no.9:498-502 S '62.

1. Katedra Inżynierii Chemicznej, Politechnika, Warszawa.

CIBOROWSKI, J.

"Essentials of chemistry" by J.Givaudon, P.Masson, R.Bensimon,
J.Deschamp, E.Bogmer, I.de Bernardi, H.Gardy, Y.Pasternak,
H.Bonnaud. I. le Mounier, A.Flament. Reviewed by J.Ciborowski.
Przem chem 41 no.6:342-343 Je '62.

CIBOROWSKI, Janusz; IWINSKI, Jan

Removal of sulfur aerosols in the Venturi nozzle. Przem chem 41
no.12:719-723 D '62.

1. Zaklad Inzynierii Chemicznej, Instytut Chemii Ogolnej, Warszawa.

CIBOROWSKI, Janusz; WRONSKI, Stanislaw

Studies on the efficiency of heat recovery in a cyclone exchanger working with a fluidized-solid furnace. Przem chem 42 no.1:38-41 Ja '63.

1. Katedra Inzynierii Chemicznej, Politechnika, Warszawa.

CZARNOTA, Tadeusz; CIBOROWSKI, Janusz

Continuous method studies on the decomposition of sodium
hydrogen carbonate in a fluidized bed. Przem chem 42
no. 6:313-317 Je '63.

1. Zaklad Inzynierii Chemicznej, Instytut Chemii Ogolnej,
Warszawa.

CIBOROWSKI, Janusz; WOLNY, Andrzej

Determination of the condensation degree of sulfur based
on a thermodynamic diagram. Przem chem 42 no.6:317-320
Je '63.

1. Katedra Inzynierii Chemicznej, Politechnika, Warszawa.

CIBOROWSKI, Janusz; WRONSKI, Stanislaw

Mass and heat transfer from fluidized bed of sublimate material to the cooler wall. Chemia stosow 6 no. 4:529-540 '62.

1. Katedra Inzynierii Chemicznej, Politechnika, Warszawa, i Zaklad Inzynierii Chemicznej, Instytut Chemii Ogolnej, Warszawa.

CIBOROWSKI, Janusz; WLODARSKI, Andrzej

Studies on the static electrization phenomena occurring in
a fluidized bed. Chemia stosow 6 no. 4:541-554 '62.

1. Zaklad Inzynierii Chemicznej, Polska Akademia Nauk,
Warszawa, i Politechnika, Warszawa.

CIBORCWSKI, Janusz; WIODARSKI, Andrzej

Influence of static electrization on the dynamics of a fluidized bed. Chemia stosow 6 no. 4:555-566 '62.

1. Zaklad Inzynierii Chemicznej, Polska Akademia Nauk i Politechnika, Warszawa.

GIBOROWSKI, Janusz; BADZYNSKI, Mirosław

Rate of gravity flow of granular material from conically
bottomed containers. Chemia stosow 7 no.3:289-314 '63.

1. Zaklad Inzynierii Chemicznej i Konstrukcji Aparatury,
Polska Akademia Nauk, Gliwice, i Katedra Inzynierii Chemicznej,
Politechnika Szczecin.

CIEBOROWSKI, Janusz; PADEREWSKI, Mscislaw

Electric method of determining the velocity of air necessary
for the initiation of bed expansion. Chemia stosow 7 no.4:
509-517 '63.

1. Katedra Inzynierii Chemicznej, Politechnika, Szczecin.

CIBOROWSKI, Janusz

Works of the Laboratory of Chemical Engineering of the
Institute of General Chemistry on fluidization. Przem
chem 42 no.12:698-700 D'63.

CIBOROWSKI, Janusz

Graphic method of calculating fluidized drying. Chemia stosow 3
1 no.1:35-43 '64.

1. Department of Chemical Engineering of the Warsaw Technical
University. Submitted October 18, 1962.

POLAND

CIBOROWSKI, Stanislaw, Prof. dr.

Director, Dept. of Radiochemistry, Institute of General Chemistry
(Kierownik Zakladu Radiochemii w Instytucie Chemii Ogolnej),
Warsaw

Wroclaw, Wiadomosci chemiczne, No 7, July 1965, pp 511-521

"Prospects for nuclear radiation application in catalysis."

CIBOROWSKI, S.

Ciborowski S.

Ciborowski S. "Purification and Hydrogenation of Naphthalene to Tetralin."
(Oczyszczanie i uwodornianie naftalenu do tetraliny). Przemysl Chemiczny,
No 2-3, 1950, pp. 132-134, 4 tabs.

A method has been elaborated for purification of naphthalene by way of heating with fused sodium. The hydrogenation process was observed in a totating autoclave in the presence of two different catalysts. The influence of various factors, such as; the degree of hydrogen and naphthalene purity, the temperature of the reaction, the pressure, the quality of the catalyst and its amount and size of grain were examined with regard to the above process.

SO: Polish Technical Abstracts No. 2, 1951

CA CIBOROWSKI, S.

10

Purification and hydrogenation of naphthalene. F. Treszczanowicz and St. Ciborowski. *Przemysl Chem.* 6, 132-4 (1950).—A method is given for the purification of $C_{10}H_8$ contg. 0.13-0.16% S with metallic Na, and its subsequent hydrogenation to tetrahydronaphthalene. The kinetics of the hydrogenation reaction in the presence of different catalysts (e.g., $CuO + Cr_2O_3$ on SiO_2 gel, or $Ni-Al_2O_3$) was investigated and the influence of the degree of purity of the $C_{10}H_8$ and H, the temp. of the reaction, the H pressure, and the quality, amt., and grain size of the catalyst on the hydrogenation reaction were examined.

Frank Gouet.

Ant. Abs. CIBOROWSKI, S.

BT-3 Petroleum

New antiknock substance. S. Ciborowski (Praw. chem., 1950, 6, 277-280).—Xylidine is recommended as an antiknock substance. R. Tataros.

Hydrogenation of Polish naphthalene to decahydronaphthalene. Edward Trepczanowicz and Stanislaw Ciborowski. *Prace Glownego Inst. Chem. Przemyslowego* 1961 (English summary); *cf. C.A.* 46, 3989f. — Three catalysts were examd.: Ni on Al_2O_3 (I), $NiCO_3$, and copptd. carbonates of Ni, Cu, and Mn. Best results were obtained at 230° and 3) atm. from I and naphthalene (purified with fused Na) with H free of CO, O, and S compds.
T. T. Galkowski

PTA CIBOROWSKI, S.

6

1168

542.943.7 : 546.77/78—31.09 : 547.533

Treszczanowicz E., Ciborowski S., Wesolowski J., Niszczynski M., Kochanowicz W. Catalytic Oxidation of Toluene.

„Kontaktowe utlenianie toluenu”. Przemysł Chemiczny, No. 4, 1951, pp. 246—250, 3 figs., 1 tab.

Catalytic oxidation of toluene with atmospheric oxygen in gaseous phase gives 5% of benzoic acid; 39% benzaldehyde and 36% maleic acid in relation to the mole fraction of toluene used. The conversion was 80%. Vanadium and molybdenum oxides on electrocorundum of Polish production were used as catalysts.

CIBOROWSKI, S.

Poland/Chemical Technology - Chemical Products and Their Application. Treatment of
Solid Mineral Fuels, I-12

Abst Journal: Referat Zhur - Khimiya, No 19, 1956, 62553

Author: Grzelewski, L., Ciborowski, S.

Institution: None

Title: Determination of Benzene, Toluene and Xylenes in Mixtures Thereof

Original

Periodical: Oznaczanie benzenu, toluenu i ksilenow w ich mieszaninie, Przem.
chem., 1955, 11, No 7, 375-380; Polish; Russian and English resumes

Abstract: A rapid (duration 35 minutes) and simple method has been worked out
for the determination of the amounts of benzene (I), toluene (II)
and xylenes (III) in mixtures by means of a single fractionation.
A graph has been plotted for computing the percentage content of the
components. The method is applicable to mixtures of I with 0-18%
II and III. Accuracy of the method is $\pm 0.4\%$.

Card 1/1

CIBOROWSKI, ST.

POLAND / Chemical Technology, Chemical Products and Their Application. Industrial Organic Synthesis.

Abstr Jour: Raf Zhur-Khalsky, No 9, 1959, 33340.

Author : Milecinski, K., Gellor, W., Gaborowski, St., Orszalewski, L., Kozanowski, G., Popowicz, M., Tronczewski, K.

Test : Not given.

Title : From the Investigatory Works in the Synthesis of Methyl Benzene.

Orig Pub: Przem. chm., 1957, 13, No 9, 546-550.

Abstract: During the study of the effects of different conditions on the catalytic reaction of the methylation of C_6H_6 by means of CH_3OH in the presence of catalysts (C) containing P_2O_5 , it was discovered that the most favorable conditions are:

Card 1/3

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Abstract: 240° ; about 25 atm.; the molar proportion, $C_6H_6:CH_3OH = 1:1$; the speed of delivery, 1.25 l. an hour per one l. of C in one hour. The unrefined product contains: methyl benzene, about 1% by volume; yield of toluol, 50-60%; xylene, 20-25% (50% of these, p-xylene) and 20% compounds of C₈. The yield of methyl benzene is proportional to the time of contact with C within a 7-minute limit. The activation energy is 25 Cal./mol.; the methylation reaction is a reaction of zero sequence. The maximum content of P_2O_5 in C is 60-70%; the effect of the

Card 2/3

Abstract: other component parts is insignificant. The C desaturation, as a consequence of some sedimentation causing the formation of gaseous products (H_2 , CO , CO_2 , saturated and unsaturated hydrocarbons), may be prevented by the addition of 5% water to the raw material. -- I. Matyova.

Card 3/3

210

POLAND/Physical Chemistry. Kinetics. Combustion. Explosions.
Topochemistry. Catalysis.

B-9

Abs Jour: Ref Zhur-Khim., No 13, 1958, 42628.

Author : Grzelewski L., Ciborowski St.

Inst :

Title : Static Method of Studying the Activity of Catalysts.

Orig Pub: Przem. chem., 1957, 13, No 8, 449-451.

Abstract: The paper describes a static manometric method of comparative determination of the activity of catalysts, applicable in those instances when one or all substrates and products are liquid, and the catalytic process occurs in the gaseous phase. Due to the simplicity of the equipment the process can be carried out on a small, laboratory, scale. An example is given of the application of this method in testing

Card : 1/2

. FCLAND/Physical Chemistry. Kinetics. Combustion. Explosions.
Topochemistry. Catalysis.

B-9

Abs Jour: Ref Zhur-Khim., No 13, 1958, 42628.

of activity of phosphate catalysts used in the re-
action of alkylation of C_6H_6 with methanol.

Card : 2/2

CIBOROWSKI, S.

On Destructive Hydration of Thiophene on Cobaltous Sulphide by S. CIBOROWSKI,
Page 457, Przemysl Chemiczny, No. 8, 1957.

4
2 May

7 7

hydrogenation of acetone to isopropyl alcohol and de-
hydrogenation of isopropyl alcohol to acetone. Stanislas
Ciborowski (Inst. Gen. Chem., Warsaw). Chim. & Ind.
(Paris) 86, 240-7 (1953).—Vapor-phase hydrogenation of
Me₂CO (l) at 1 atm. on a catalyst of Cu, ZnO, and Al₂O₃,
using a mole ratio of H₂ of 5:1, gives high-purity iso-PrOH
for pharmaceutical preps. The equil. const. for the hydro-
genation at 180–200° is given by $\log K_p = -8.081 + 2893/T$.
The kinetics is discussed. L. R. Caswell

GW
4

929

CIBOROWSKI, S.

4
Kinetics of gas reactions in flow systems. Stanislaw
Ciborowski and Edward Łozefowicz (Politechnika Łódź,
Poland). *Wiadomości Chem.* 13, 257-69 (1959) (English
summary).—Math. interpretation of simple gas reactions in
flow systems is discussed. 24 references. A. Kreglewski

4

12

CIBOROWSKI, S.

Investigations on the statics of the reaction of hydrogenation of acetone to isopropyl alcohol. Stanislaw Ciborowski (Inst. Chem. Ogólnej, Warsaw). *Roczniki Chem.* 31, 469-471 (1959) (English summary); cf. C.A. 53, 11194b. Studies were carried out on the catalytic hydrogenation of Me₂CO to iso-PrOH by H₂ at 1 atm. and 100-200°, as well as dehydrogenation of iso-PrOH to Me₂CO. The catalysts used were: Cu on silica gel, prepd. by satn. with Cu(NO₃)₂·3H₂O and heating 5 hrs. at 450°, and Cu from Cu-Al alloy (50% Cu) by a method analogous to prepn. of Raney Ni.

Both catalysts were reduced *in situ*. These catalysts were highly selective and sufficiently active to assure equil. in the reaction mixt. at adequately chosen times of contact of the flowing vapors. The results were expressed by the equation $\log K_p = -0.061 + 2.893(10^3)/T$, and confirmed the results obtained by Kolb and Burwell (C.A. 39, 3986f).

A. Krogalski

4
2 May
423d

CIBOROWSKI, S.

The kinetics of the reversible contact reaction of isopropyl alcohol/dehydrogenation. Stanisław Ciborowski (Inst. Chem. Ogólnej, Warsaw). *Acta Chem.* 33, 145-55 (1959) (English summary); cf. C.A. 53, 16929i. — The following kinetic equation was derived for some reversible reactions of the type $A \rightleftharpoons B + C$: $k_1/V_s = Ay + B \ln(1 - Wy/m) + C \ln(1 - y/m)$, where k_1 is a const. proportional to the reaction velocity const., m the max. thermodynamically possible conversion of the substrates in the given conditions, and y the actual conversion. $A = (m - W)^2 / (1 - W)$, $B = m(m - 1)^2 / W(1 - W)$, $C = m(m - W) / (1 - W)$, and $W = 2m - mZ - 1$, where Z is the proportional adsorption coeff. Studies on iso-PrOH dehydrogenation to acetone on Cu catalysts at 130-150.3° and up to $m = 80\%$ confirm the relation. The sum of Z for acetone and H is 3.5 at 150.3° and 5.0 at 130.0°. A. Kreglewski

4E3d

2 J. J. (May)

CIBOROWSKI, S.

Distr: 4E2c(j) 1

Synthesis of cyclohexanone and cyclohexanol from benzene through cyclohexane. I. Stanisław Ciburowski. *Przemysł Chem.* 38, 413-15(1959).—A general review article covering the production of polyamide fibers and nylon fibers, stressing the economic importance of cyclohexane.

Francis M. Kujawa

4
1-9-7 (NB)

SS

CIBOROWSKI, ST.

reports to be presented at the 2nd Intl Congress on Catalysis, Paris, France, 4-9-Jul '60.

Poland

MARJONSKI, B., SZALONSKI, M., and SZKLANIA.
 SZKLANIA, Z. - "Properties of nickel layers
 electrocatalytically hydrogenated in the presence
 of poisons" (Section II)
 MARJONSKI, B., SZKLANIA, Z., and
 SZKLANIA, Z. - "Electronic processes
 accompanying the catalytic dehydrogenation
 of alcohols on semiconducting oxide catalysts"
 (Section II)
 MARJONSKI, B. - "On the process of catalytic
 reaction of sulfur dioxide with acids in iron
 sulfate solution" (Section III)
 MARJONSKI, B. - "On trace catalysts" (Section II)
 LITKA, A., MARJONSKI, B., and SZKLANIA, Z. -
 "The gaseous phase transformation of a mixture
 of 3-picoline and 4-picoline in the presence
 of ammonia and air in a mixture of corresponding
 nitrites" (Section III)
 MARJONSKI, B., and KUBIENSKI, Z. - "Hydrogen
 transfer in gaseous phase between alcohols
 and compounds containing carbonyl groups"
 (Section I)
 MARJONSKI, B., MARJONSKI, Z., and
 KUBIENSKI, Z. - "Studies on catalytic
 activity and catalytic activity
 promoted zinc oxide during isopropyl
 dehydrogenation" (Section III)
 MARJONSKI, Z. - "Study of selectivity and activity
 of copper catalysts in dehydrogenation
 reaction" (Section III)
 SZKLANIA, A., and SZKLANIA, Z. - "Influence
 of dimensions of pores on the catalytic power
 of active carbon in the oxidation of sulfur
 hydrogen by oxygen" (Section II)

CIBOROWSKI, Stanislaw

Synthesis of cyclohexanone and cyclohexanol from benzene through cyclohexane. Pt. 3. Studies on the hydrogenation of benzene to cyclohexane. Przem chem 39 no.4:228-231 Ap '60.

1. Zaklad Syntezy Kontaktowej, Instytut Chemii Ogolnej, Warszawa

P/016/61/000/004/001/001
D227/D306

AUTHOR: Ciborowski, Stanisław, Doctor, Docent, Director

TITLE: Radiochemical oxidation of hydrocarbons

PERIODICAL: Wiadomości chemiczne, no. 4, 1961, 225-246

TEXT: A short review of the effects of ionizing radiation on the oxidation of paraffins, olefins, alicyclic and aromatic hydrocarbons. In the majority of cases oxidation with molecular oxygen is studied. Oxidation in a non-oxidizable solvent is more complex than that of pure or mixed hydrocarbons, because most of the radiation is absorbed by the solvent, but the yields may be increased. On radiolysis the solvent provides activated molecules, ions and free radicals, which then combine with oxygen and attack the solute. Water, which gives H^\bullet , OH^\bullet and O_2H^\bullet is quoted as an example. Chain mechanism is a characteristic feature of these reactions, with high radiation yield G, (defined as the number of

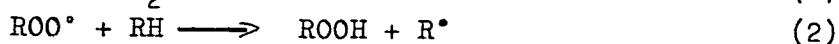
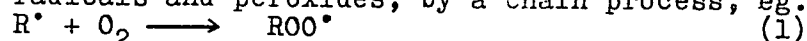
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Radiochemical oxidation of ...

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D227/D306

molecules formed or changed for every 100 ev of radiation absorbed). The mechanism is also affected by reaction parameters, notably temperature. Ionising radiation may initiate a chain reaction which is then self-sustaining, or enable a non-chain reaction to proceed. Constant irradiation is needed when the chains are short. Conventional oxidation of hydrocarbons is known to proceed through the formation of free radicals and peroxides, by a chain process, eg.:



The peroxides then decompose to form alcohols, aldehydes, ketones, carboxylic acids and free radicals which lead to chain branching. These reactions are characterized by an induction period, during which the peroxides are formed. Excessively long times of induction may be shortened by means of catalysts, higher temperatures or strong oxidizing agents, and N.M. Emanuel (Ref. 6: DAN SSSR (DAS, USSR), 1956, 111, 1286); N.M. Emanuel, E.A. Blumberg, D.M. Ziv, and V.L. Pikayeva (Ref. 7: DAN SSSR (DAS USSR), 1958, 119,

Card 2/6

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1183) showed the same to be true of radiation. In addition, the reaction rates were sometimes faster after irradiation. Chain reactions can only be sustained after radiative initiation if the temperature is sufficiently high. Such initiation may also take place in the absence of oxygen, probably by removing natural inhibitors present in the hydrocarbon, leaving the compound in a reactive state. The induction period is then merely the time required for the formation of peroxides (from dissolved oxygen). The effect of irradiation of the rate of reaction after initiation is uncertain. Saturated hydrocarbons oxidize in the liquid phase at or above 100°C by a chain mechanism. Irradiation decreases the induction period and allows the oxidation to proceed at lower temperatures by forming free radicals with energies greater than the activation energy of reaction (2). Formation of asymmetric peroxides, and lack of dependence of the oxidation rate on temperature is characteristic of the reactions. At these moderate temperatures, G is usually low. Typical products include organic peroxides,

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H₂O₂, aldehydes, ketones and acids. This is illustrated in some detail by the radiative oxidation of n-heptane, iso-octane and cyclohexane, at room temperature. It is shown that the type of products and temperature below which the chain mechanism cannot operate (T), depends largely on the structure of the hydrocarbon. Above T the reactions become strongly temperature dependent with high values of G. Specially reactive compounds may, however, oxidize by a chain process even at room temperature. The lower paraffins (methane, ethane, propane) cannot be oxidized in the liquid state because their critical temperatures are too low. Oxidation proceeds reluctantly in the vapor phase and the products are not typical of this class of compounds. It has not been possible to initiate chain reactions with consequently high G values. This is illustrated by the oxidation of propane and methane, the latter both as a gas and in an aqueous solution. Olefins oxidize more readily by a chain mechanism, yielding mainly aldehydes and ke-

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tones, and the effect of radiation is less pronounced than a rise in temperature to 100 - 150°C. Irradiation is most useful in the case of volatile olefins which cannot be oxidized conventionally. The effect of radiation on the oxidation of gaseous and aqueous ethylene, which has been studied by Western authors with contradictory results, is described. Aqueous acetylene has been found to oxidize by a non-chain mechanism when subjected to X-rays. Aromatic hydrocarbons are more resistant to oxidation than aliphatic or alicyclic. Oxidation of benzene to phenol and diphenyl is described in some detail. Radiation yield is markedly increased in the presence of air, water or Fe^{2+} ions and is little affected by the pH of the solution, dose and energy of the radiation within 1.2-23 Mev, as indicated by G.R. Freeman, A.B. van Cleave and J.W. Spinks (Ref. 28: Canad. J. Chem., 1953, 31, 448) and oxygen pressure (up to 28 atm.) (Ref. 29: M.A. Proskurin and E.V. Barel'-ko: Sbornik rabot po radiatsionnoy khimii (Symposium of Research on Radiation Chemistry), 99, Moskva, 1955). The reaction rate and

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G are affected by temperature only above $\sim 100^{\circ}\text{C}$. This indicates a non-chain mechanism below and a chain mechanism above $\sim 100^{\circ}\text{C}$. Phenol should be removed continuously as it tends to inhibit the reaction. A disadvantage of high temperature (200°C) oxidation is the formation of tarry products. The author anticipates an increasing use of radiation chemistry in industry. There are 2 figures and 33 references: 19 Soviet-bloc and 14 non-Soviet-bloc. The references to the English-language publications read as follows: J.L. Liebenthal, L.F. Albright and A. Sesonke, "The effect of γ -radiation on the low temperature oxidation of propane" - paper given at the 2nd conference for peaceful applications of nuclear energy, Geneva, 1958; P.G. Clay, G.R.A. Johnson and J. Weiss, Proc. Chem. Soc., 96, 1957; P.G. Clay, G.R.A. Johnson and J. Weiss, J. Chem. Soc., 2175, 1958; M. Daniels, G. Scholes and J. Weiss, J. Chem. Soc., 832, 1956.

ASSOCIATION: Zakład radiochemii w instytucie chemii ogólnej w Warszawie (Department of Radiochemistry at the Institute of General Chemistry, Warsaw).

SUBMITTED: September 28, 1960

Card 6/6

P/014/61/040/001/005/007
A221/A126

AUTHOR: Ciborowski, Stanisław

TITLE: Synthesis of cyclohexanone and cyclohexanol from benzene through cyclohexane - IV. Investigations on cyclohexane oxidation

PERIODICAL: Przemysł Chemiczny, v. 40, no. 1, 1961, 32-34

TEXT: The investigation on the cyclohexanone oxidation process was undertaken because the oxidation products, cyclohexanone and the cyclohexanol, are important cheap semiproducts for synthetic polyamide fiber production. The preliminary work on cyclohexane oxidation with air in a liquid phase was carried out intermittently on a laboratory scale and repeated on a quarter technical scale as a continuous process. The layout of the quarter-technical scale installation is shown on the attached figure. The principal parts of it are two reactors connected in series (5, 6) of 75 mm diameter, 1.6 m high and about 7 litres capacity each. Cyclohexane and air are pumped through these reactors; the pump (4) picks up the cyclohexane from the measuring vessel (3) and delivers it to the reactor (5), while the air is blown by a compressor (1) through a pressure equalizing container (2). The crude product of oxidation is removed from the

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reactor (6) via the cooler (13). After passing through their respective gas coolers (7 and 8), cold exhaust gas is released into the atmosphere through the gas meters (11 and 12). Water vapor and cyclohexanone condensed in the coolers are collected in separators (9 and 10); cyclohexanone is diverted back into the reactor (5) and water is drained. The air enters the reactors independently and its rate is adjusted by operating exit valves fitted before the exhaust gas meters. Cobalt naphthens was used as catalyst for those experiments. The most important parameter of this process is the temperature. In this particular case, a temperature range of 120-175°C has been applied. The output increased with the rising temperature, but at higher temperatures the product obtained was dark. Catalyst efficiency also depends on the temperature, especially during the induction period; once this is completed, its influence is rather insignificant. However, catalyst presence increases the output of cyclohexanone at the expense of the cyclohexanol. The process was carried out at 7-20 atm pressure, which consisted of partial pressures of cyclohexanone vapor and of gases. Partial pressures of cyclohexanone at 140, 150, 160 and 170°C are 4.5, 5.5, 6.7 and 8.0 atm respectively, therefore the process pressure has to be higher. Expected positive influence of higher pressure on the oxidation reaction was not confirmed. Also the dispersion of air blown through the liquid, i. e. whether the air was

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blown through 0.5 or 5.0 mm holes, had little effect on the oxidation process. An important factor influencing the output of individual products is the degree of cyclohexane conversion. High output of cyclohexanone and cyclohexanols can be obtained only at low substrate conversion, otherwise acids of mono- and di-carboxylic nature are formed. They are capric- adipic- formic- glutamic- and succinic acids and some others, in smaller quantities, as well. Because of acid formation, particularly of formic acid, problems of corrosion were also investigated. Most resistant to formic acid is steel containing 2% of molybdenum, the H18, N12, M2T similar in composition to the V4A steel. The installation described was made of KP2 (chromium-nickel) steel, and no corrosion was observed. Knowing that aluminum resists formic acid, one of the reactors was lined with 99.5% aluminum sheet. After several hundred working hours there was no sign of corrosion observed; obviously the 99.9% aluminum will be even better for this purpose. Optimum parameters for this process were established as follows: method of work - continuous process in two reactors connected in series; temperature - 150°C in no. 1 and 150°C in no. 2 reactor; pressure - 20 atm; time of reaction, i. e. time of liquid in the reactor - 20 min in each reactor, i. e. 40 min total; cyclohexane conversion - 4.5% in each reactor, total 9%; air supply - independent to each reactor at the rate of 0.3 m³/h (N.P.T) for each liter of liquid to be oxidized.

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Composition of the crude product after the water was separated in % by weight: cyclohexane - 88.8, cyclohexanone - 3.6, cyclohexanol (free) - 2.8, cyclohexanol in esters - 0.7, other neutral compounds - 0.7, di-carboxylic acids, calculated as adipic acid - 1.7, mono-carboxylic acids calculated as capric acid 1.7 = 100%. The output of useful products in percent of theoretical output (without losses): cyclohexanol [Abstractor's note: It is obvious misprint, it should read cyclohexanone.] - 33.5, cyclohexanol (free) - 26.8, di-carboxylic acids - 11.0 = total 71.3%. Consumption of cyclohexane for 1 kg of cyclohexanone and free cyclohexanol (without losses) = 1.42 kg/kg. There is 1 figure and 22 references: 9 Soviet-bloc and 13 non-Soviet-bloc. The reference to the most recent English-language publication reads as follows: W. Sherwood, World Petrol, 31, 48 (1960).

ASSOCIATION: Instytut Chemii Ogólnej (General Chemistry Institute) Warsaw.

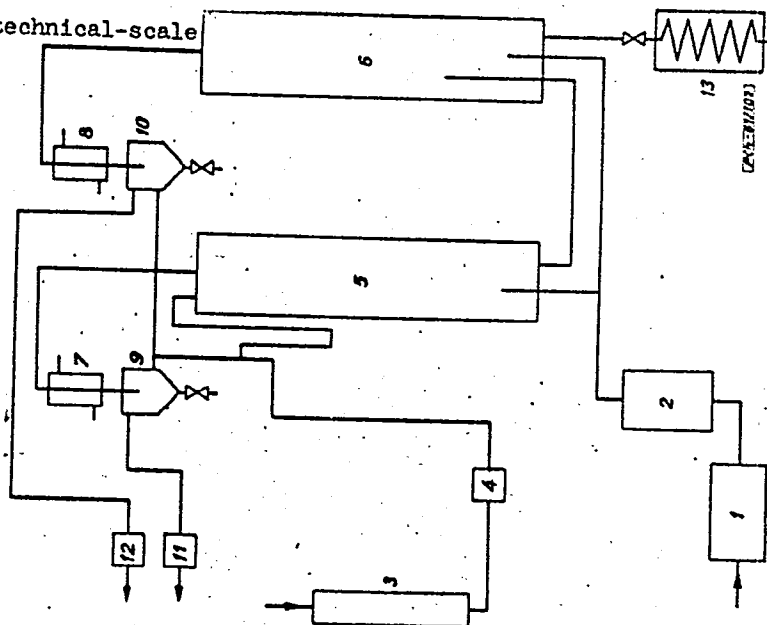
SUBMITTED: July 11, 1960

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Synthesis of cyclohexanone and cyclohexanol ...

P/014/61/040/001/005/007
A221/A126

Figure 11:
Layout of quarter-technical-scale
installation



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CIBOROWSKI, Stanislaw

Second International Congress on Radiation Research. Przem
chem 42 no.1:48 Ja '63.

CIBOROWSKI, Stanisław

Possibility of caprolactam extraction by using cyclohexanone oxime.
Przem chem 41 no.11:652 N '62.

1. Instytut Chemii Ogólnej, Warszawa.

OPALINSKA, Irena; CIBOROWSKI, Stanislaw

The effect of γ -irradiation on the catalytic activity of nickel.
Rocz chemii 36 no.9:1369-1372 '62.

1. Department of Radiochemistry, Institute of General Chemistry,
Warsaw.

PHASE I BOOK EXPLOITATION

POL/6243

Ciborowski, Stanisław.

Chemia radiacyjna związków nieorganicznych (Radiation Chemistry of Inorganic Compounds). Warsaw, PWN, 1962. 290 p. (Series: "Chemia współczesna", t. 9) 2200 copies printed.

Editorial Board: Osman Achmatowicz; Alicja Dorabialska; Zbigniew Grabowski; Józef Hurwic; Chairman of the Committee; Wiktor Kemula; Jerzy Kroh, Deputy Chairman; Mieczysław Michalski; and Tadeusz Urbanski.

PURPOSE: This book is a basic manual on radiochemistry intended for graduate chemists and physicists.

COVERAGE: The book deals with the fundamentals of the radiation chemistry of inorganic compounds. Special attention is given to the existing hypotheses of the mechanism of radiation processes. Organic compounds will be covered in a separate volume. References are given at the end of each chapter.

Card 1/1

S/081/63/000/002/058/088
B171/B102

AUTHOR: Ciborowski, Stanisław
TITLE: Preparation of ketones from alicyclic alcohols
PERIODICAL: Referativnyy zhurnal. Khimiya, no. 2, 1963, 406, abstract
2N50 (Polish patent 45794, April 18, 1962)

TEXT: Ketones are prepared from alicyclic alcohols (AA) by heating them with aromatic compounds in liquid phase in the presence of a catalyst (CT), accelerating the reaction of hydrogenation of aromatic cycles such as Ni. AA is dehydrogenated to ketone at the same time as an aromatic compound is hydrogenated to an alicyclic one. The reaction takes place at relatively low temperature ($\sim 170^{\circ}\text{C}$) because the aromatic compound is hydrogenated by the release of H_2 previously adsorbed on the CT surface. The advantages of the new method are the high reaction rate and the possibility of using H_2 to hydrogenate aromatic compounds directly. The differences between this and the other known methods are illustrated by the following example: when cyclohexanone (I) is prepared from

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phenol (II), only a part of II is hydrogenated to cyclohexanol (III) and the hydrogenation of the remaining II is carried out simultaneously with the dehydrogenation of III to I by heating the liquid-phase-mixture of III and II in the presence of a CT (e.g. Ni) at $\sim 170^{\circ}\text{C}$. The liberated H_2 hydrogenates II to III. The excess of H_2 is removed from the reactor together with the vapors of reagents eliminated by distillation. The amount of these reagents is regulated in order to ensure a complete elimination of I. The distilled vapors are condensed, the condensate is vacuum-distilled to separate the pure I, and the remainder is finally returned into the reactor (RT). The reaction is conducted continuously, and III and II are continuously fed into the RT. The reaction rate depends on the I-content in the reacting mixture. When the I-content $\sim 30\%$ by weight and the CT-content $\sim 5\%$ by weight, 1-2 kg/hr of I are formed for every kg of the CT. For lower concentrations of I, this quantity shows a considerable increase. The dehydrogenation of III to I is carried out in a similar way when the reaction involved is the hydrogenation of C_6H_6 to C_6H_{12} . The reaction temperature is regulated by the choice of a proper pressure. The new method allows of preparing

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ketones from various AA. A reactor provided with a stirrer and a heating coil is loaded with a mixture of 40% of II and 60% of III, containing also 1-10% of regenerated Ni dust CT. The mixture is heated to $\sim 170^{\circ}\text{C}$. As a result of the reaction, III changes to I and II is hydrogenated to III. The product of the reaction is distilled and simultaneously an adequate quantity of a mixture of 80% of III and 20% of II is introduced into the RT. H_2 is separated by condensation from the vapors discharged from the RT. I, having the lowest boiling point, is separated from the liquid by vacuum-distillation, and the remainder is returned to the RT. After establishment of equilibrium, the mixture contained in the RT has $\sim 50\%$ of III, $\sim 30\%$ of II, and $\sim 20\%$ of I. The yield of I is 98-99%.
[Abstracter's note: Complete translation.]

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PHASE I BOOK EXPLOITATION

JUN 25 1963

POL/6243

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Chemia radiacyjna związków nieorganicznych (Radiation Chemistry of Inorganic Compounds). Warsaw, PWN, 1962. 290 p. (Series: "Chemia współczesna", t. 9) 2,200 copies printed.

Editorial Board: Osman Achmatowicz; Alicja Dorabialska; Zbigniew Grabowski; Józef Hurwic; Chairman of the Committee; Wiktor Kemula; Jerzy Kroh, Deputy Chairman; Mieczysław Michalski; and Tadeusz Urbanski.

PURPOSE: This book is a basic manual on radiochemistry intended for graduate chemists and physicists.

COVERAGE: The book deals with the fundamentals of the radiation chemistry of inorganic compounds. Special attention is given to the existing hypotheses of the mechanism of radiation processes. Organic compounds will be covered in a separate volume. References are given at the end of each chapter.

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